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Extension PEST MANAGEMENT PILOT PROJECTS

. . . an evaluation

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FOREWORD

This study was funded by Extension Service-U.S. Department of Agriculture to evaluate the accomplishments, operations, and procedures that have been used in Extension pest management projects.

The study was conducted by B. D. Blair, Extension Entomologist, Professor and Research Entomologist, the Ohio State University and the Ohio Agricultural Research and Development Center.

It should prove useful to anyone planning a pest management program.

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EXTENSION PEST MANAGEMENT PILOT PROJECTS-- AN EVALUATION

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SUMMARY

During the period 1971-1975, 39 federally funded pest management pilot projects existed in 29 states. For this study, on-site, mail, and phone interviews were conducted for 26 projects in 18 states.

All projects studied were considered successful. Some were much more successful than others in terms of grower acceptance and support, but all contributed to one or more goals of pest management. Most of these projects resulted in gains in economic efficiency in agriculture. Most reduced the use of pesticides; others certainly avoided escalation of pesticide use. Most have developed a capability to cope with multi-pest problems in a management system that will produce an adequate supply and acceptable quality of food and fiber.

In addition to the pest management goals attained, many projects have provided more refined and accurate ways for people to make intelligent decisions about the need for pest control. Better monitoring methods have been developed because of large-scale implementation of the methods developed earlier by research. The use of computers and development of workable models have allowed more efficient use of personnel and increased precision in making pest management decisions. This would not have been possible without the pilot projects.

One real accomplishment was the development of mobile equipment, connected by telephone to a university computer. With this, data can be fed into the computer from the field, providing a rapid printout telling the producer whether or not control is needed. This was accomplished in several projects. The use of trail bikes and other all-terrain vehicles helped increase pest management efficiency. The training of personnel at all levels, as pilot projects were developed, contributed greatly to the success of the projects. In several instances, personnel trained by Extension have started private consulting businesses of their own. In other instances, private firms or consultants used university training programs (developed from pilot projects) and the personnel who were taught by Extension personnel. In some states, changes were made in university curricula for pest management because of experience gained from the pilot projects.

The usefulness and efficiency of dial-a-message phones, two-way radios, computer terminals, portable teletype machines, and mobile laboratories

were demonstrated in many projects. Some projects promoted nearly complete cooperation between people in private and public sectors. This resulted in a better program for all. Extension educational materials developed and published as a part of pilot pest management programs were useful in informing farmers and the public of the benefits of pest management. These can be used to develop future programs.

INTRODUCTION

Although pest management is not new in many areas of the United States, a major effort has been made during the period 1971 to 1975 to develop and establish pest management on many crops and in new areas of the United States. During this period, 39 USDA-funded, 3-year pilot projects existed in 29 states.

Factors common to successful projects were identified in this study, which was made during the spring and summer of 1975.

On-site, mail, and phone interviews were conducted for 26 projects in 18 states studied. Those interviewed included project leaders; Extension entomologists, plant pathologists, and weed scientists; county Extension advisors and agents; state departments of agriculture personnel; personnel of the Animal and Plant Health Inspection Service (APHIS); ag-chemical industry personnel; custom applicators; and growers. From them, appropriate data were assembled for this analysis.

Projects studied included those involving alfalfa, apple, corn, cotton, sorghum, sweet corn, tobacco, peanuts, pears, and peppers.

Pest management project personnel can be grouped according to the type of contributions made to pilot projects. This allows the contributions of each group to be identified more clearly. A grouping of project contributors also allows comparison of personnel (including background and experience of each contributor). Following a study of project proposals, annual reports and visits with Extension Service (ES), Economic Research Service (ERS), Environmental Protection Agency (EPA), and Office of Management and Budget (OMB), personnel in Washington, D.C., a questionnaire (see appendix) was developed to be used as an interview guide. Responses to this questionnaire are the bases for this report.

Pilot projects have involved many people in various roles. These include those who serve on various committees, administrators at different levels, state and federal government personnel, research personnel, project leaders, specialists, agents, scout supervisors, scouts and producers. This study attempted to identify the effort and effectiveness of each of these groups in developing a successful project. The study was also designed to determine factors for determining the future role, funding, etc., of pest management in the United States.

COMMITTEES INVOLVED

Committees that provided guidance for these pilot pest management projects included: state steering, advisory, action, grower, regional steering (more than one state), and area steering committees. Boards of directors of commercial organizations cooperating with project personnel (California), the Subcommittee on Ecological Monitoring (Alabama), Subcommittee on Diapause (Alabama), a committee of representatives from grower community co-ops (North Carolina), a coordination committee (Indiana), and county scouting committees (Arkansas), also provided guidance.

State steering committees usually consist of representatives from federal and state agencies. Similarity of state steering committee structures resulted from suggestions by USDA-Extension personnel when project proposals were written. Personnel from the State Department of Health, State Department of Agriculture, research, Animal and Plant Health Inspection Service (APHIS), and Cooperative Extension Service are most commonly those on state steering committees. The function of state steering committees appears twofold. In most projects the steering committee is the policymaking body and meets annually to review the project. Another function is to disseminate information about the program. Background (training and experience) of steering committee members varies, but frequently a majority are state agency and university administrators. A few committees included grower representatives and several included representatives from interested commercial groups including gins, processors, and agricultural chemical organizations.

Most project leaders indicated benefits from representation and contributions of all support groups early in project development. In most cases, there is a positive correlation for project success where producers, processors, and/or industry people were involved early in an advisory capacity. Representation by several state and federal agencies and from agricultural and other industry groups allows better communication and lessens chances of misunderstanding by agencies with overlapping responsibilities and interests. Representation of diverse disciplines on policymaking and action committees contributed to better projects, but unfortunately this was not always the case. Participation of economists always improved the program, especially studies of cost benefits.

PERSONNEL INVOLVED

Administrators

In interviews, project leaders rated university administrative support and commitment to the pest management project on a scale from "little effort" to "strong effort." Projects where administrative effort was supportive and available when needed progressed more rapidly than where administrative effort was strong only at a departmental level. This usually resulted in a unidisciplinary approach.

Support of university administrators improved interdisciplinary cooperation. Administrators' backgrounds (training and experience) varied, and their knowledge about pest management varied equally. Administrative decisions regarding producer contributions, particularly those that did not allow producer contributions, slowed progress of projects.

Project Leaders

Project leaders' efforts were rated from "expected" to "strong" effort. Most were senior Extension specialists with several years experience and were knowledgeable of production and pest management practices, and of educational methods and techniques. Some of the younger, inexperienced project leaders suggested that in an ideal situation the project leader should have time to spend one growing season discussing the program with growers, community leaders, and other educators before project plans were finalized.

Most assistant project leaders were recently out of school or just finishing graduate work, and project leaders delegated many responsibilities to these younger people. Effectiveness of the assistant leaders who had full responsibility for conducting programs but received guidance from project leaders ranged from expected to strong. Most project leaders indicated that the younger assistant leaders contributed new ideas and were usually extremely enthusiastic about the program.

Project leaders' evaluation of county agents indicated that their contributions ranged from no involvement to a strong contribution. In some programs, county or area entomologists gave total leadership at the county level, while in others the program was centered around the county agricultural agent's office and personnel. Practically all programs involved county agriculture agents or farm advisors in an advisory capacity. Many projects involved the county agricultural agents in original planning as well as in operation of the program from the beginning. Many project leaders indicated that there were several advantages in having county agents involved in the project; no project leader expressed a negative reaction to county agent involvement. Some leaders were of the opinion that if they had involved agents earlier in the program, and to a greater degree, the project goals would have been achieved sooner, or program quality would have been improved--especially in gaining rapid producer acceptance.

Scout Supervisors

The contributions of scout supervisors were considered essential for success in practically all projects. They had the responsibility for checking on scout performance, for field training of scouts, and serving as a vital communications link with agents, assistant project leaders, and project leaders. College students (both graduate and undergraduate), high school teachers, college graduates with M.S. and B.S. degrees, and a few supervisors with high school or vocational school backgrounds were used as scout supervisors. Usually supervisors had previous scouting experience.

Scouts

Scouts were mostly rated by project leaders as giving "expected" to a "strong" effort.

Regardless of background, most scouts quickly learned the essentials in short training sessions and performed well.

Other Personnel Associated with Pest Management Projects

Industry personnel and fieldmen, and/or consultants were employed to do field monitoring in some projects. Where there were adequate numbers of these individuals, trained and motivated, they contributed much to the projects, and, in some cases, could take over the program after the pilot or developmental phase of the project ends.

State departments of agriculture personnel were extensively involved in at least four projects, and where regulatory actions were needed, regulatory personnel were essential.

APHIS Personnel

APHIS personnel were involved to some degree in most projects. Nine projects were assigned APHIS technical personnel. APHIS state personnel were responsible for monitoring pesticides and collecting environmental samples for most projects.

Both state and federal research personnel from several disciplines were involved in some way with all projects. In many projects, researchers served in an advisory capacity, but in some projects, particularly in cotton states, some were heavily involved in the development and execution of projects.

Producers

Fifteen of the projects studied steadily increased the number of producers participating. Six had a decrease in number of cooperating producers. The educational level of producers ranged from less than high school to a Ph.D.

Most producer-cooperators were reared on farms and had some familiarity with pest control procedures before participating in the pest management program.

Interdisciplinary Cooperation

The type of pest and extent of pest losses, type of crop, the number of disciplines needed to handle pest complexes, crop value, production costs including pest control, size of crop units (small acreages, etc.), and distance between fields all affected the time required in developing a successful project.

Crops that require major pest control input make an ideal situation for developing a pilot project. However, in cases where mostly insurance type pesticide treatments (calendar spray schedules) had been used with success for years, producers were more reluctant to try new methods. On the other hand, crops with sporadic pest problems create other project developmental problems, but need not be excluded from a pest management effort. These situations (sporadic pest problems) required a more general pest and crop management program (soil sampling, weeds, diseases, nematodes as well as insects) than projects with a single serious pest problem. Most project leaders are of the opinion that enough is known about pests on most crops in the U.S. to initiate additional pilot pest management projects.

Responses to the questions "Which disciplines are involved?" and "Which disciplines should be involved?" frequently were answered differently, depending on position of leadership and discipline of the individual interviewed.

The question: "Should more disciplines be involved in the project?", was answered "yes" by leaders of 13 projects.

"Why are (other disciplines) excluded?" was answered by respondents with "lack of interest by those in other disciplines"; "no serious problems with pests handled by those in other disciplines" (essentially no need or place for other disciplines); "inadequate pest management data regarding monitoring pests and/or economic thresholds, and/or inadequate funds." Respondents indicated that interdisciplinary participation was greatly improved when there was administrative commitment of Extension Directors as well as heads of departments. Where respondents approved need for greater interdisciplinary involvement, the other disciplines mentioned were plant pathology, weed science, agricultural engineering, nematology, statistics, and economics. However, it is noteworthy that most projects were successful and fully supported by producers as a single discipline project, but most project leaders agreed that adding other disciplines would make a more complete program which is needed in dealing with complex pest situations. Seven of the project leaders who answered the question "Should more disciplines be involved" with a "no," either already had multidiscipline projects or usually were working with several insect pests on one crop. Most producers interviewed were unanimous in that they wanted all disciplines involved in pest management programs, and some wanted other crop management practices included.

Scope of Projects

Growers' crop value (gross) per acre ranged from slightly more than $100 to several projects in excess of $2,000, depending on crop and scope of the program. However, successful projects were developed throughout this range indicating that gross income per acre is not a limiting factor in project development. The cost for pest management is considered important by project leaders only because of its relation to net income. Crops with a high value per acre can be more closely supervised.

Large fields and fields located in close proximity required less scouting time and costs, and no doubt made the program financially more attractive to some growers. Producers of high-value crops, even with small fields, appeared to need and want a pest management program more than did producers of low-value crops. This is because those growers want the "insurance" and confidence of a pest management advisory service more than producers of low-value crops. Calendar spraying is also an "insurance" program, but most growers are more willing to support pest management, because it can prevent unsuspected losses from pests by early detection and timely application of corrective practices.

In the projects covered in this study, the number of the fields ranged from 33 to 6,129. Total acres ranged from 633 to 214,000. During 3 years, most projects had increases in number of farmers participating, number of fields, and number of acres each year. This clearly indicates success in gaining grower acceptance.

A few projects had reduced participation either in number of producers, number of fields or total acreages. There were several reasons for this: farmers changed crops grown; the crop acreage in project area was reduced, usually as a result of bad local weather that delayed planting; or changing market prices indirectly affected the program. Farm operators sometimes changed because of retirement, death, etc., or they "tried it because it was new" and dropped out from lack of interest.

The following reasons were cited as to why a few producers did not continue in pest management: they apparently still preferred a chemical "insurance" type program; didn't like paperwork; switched to private consultants; grew crops on contract for processor and the processor changed crops or acreage; and some occasionally misunderstood the nature of the program.

The scope of pilot projects (acres, pests, number of growers) was not a limiting factor in determining success of a project. A project size that in the beginning allows the project leader control and almost exacting supervision appears helpful. However, larger projects seem to "show more people" and as a result were better educational tools and gained quicker grower acceptance over a wider area.

Special problems encountered by project leaders in developing programs were: small fields, fields far apart, high-value crops where insurance type sprays are appealing, low cost of insurance type sprays, multiple plantings (small areas planted weekly for fresh market), attempts to develop a program beyond resources available and sporadic pest damage. Other problems listed were inadequate survey technique, production areas far from university-housed personnel, obtaining scouts for late fall work (after school starts), growers hesitant to have a check for evaluation, insecticide resistance, bad roads, aerial application obstacles (woods, wires, etc.) traditional production practices and difficulty in change, small acreage in project, and large surrounding acreage in spray-type programs. Producers with small acreages were not as interested as those with larger acreages and investments. Small acreages were less acceptable to private consultants and created special problems.

EVALUATION OF PROJECTS

Evaluation of most projects is a constant process and involves contact with producers, processors and project personnel. An annual review evaluation by the state steering committee is common. Producer testimonies are frequently used as well as grower interviews. Grower committees are used in some states to evaluate the project.

Project leaders are in general agreement that there is no known way to completely evaluate pilot projects satisfactorily. Yield, both in terms of quality and quantity; grower attitude surveys; chemical use surveys; and grower acceptance and support of projects all have proven to be of value. Most project evaluations included indications of studies on patterns of pesticides, kinds and amounts of pesticides applied, quality grades, production cost, and net profit. The scope and depth of evaluations depended on state support of evaluation and availability of suitable data. Many cooperators greatly influenced their neighbors' pest management practices, making it extremely difficult to compare project growers with non-project growers. The full educational impact of the educational program extended beyond the project growers.

Program changes resulting from state evaluations include: improved data collection; more efficient and speedy flow of information to farmers; adjusted scout acreage assignments; scouting intervals; addition of more crops to project; expanding scope of project to include nematodes, weeds, and/or plant pathogens; adjustments of thresholds to reflect current production costs and markets; and change in scout transportation methods.

Improved, frequent communication between project personnel and producers is needed in some projects. It appears that producers who get weekly or biweekly reports in addition to newsletters, etc., are more inclined to support programs.

There is great need for evaluation methods that would better compare these pest management programs with existing pest control practices. Pest management programs should be evaluated as a combination of educational methods, and the resulting changes, as well as speed of changes should be used as a measurement of success. In a number of projects, there is need for better evaluation of economic benefits of pest management because documented economic benefits will probably be needed to gain wider producer support.

PROJECTS

Non-Pest Management Practices Included in Projects

A number of auxillary practices such as soil sampling, tissue sampling, fertility recommendations, seeding or planting rates, hybrid or variety selection, etc., were added to more than 40 percent of the projects studied. Thirty-eight percent of the project leaders interviewed indicated that adding other management practices such as soil sampling for fertility recommendations made the program more appealing to producers and helped gain producer support. The implication is that growers are willing to pay for some other services as well as pest management.

Areas of State and Growers Selected for Pilot Projects

Some of the most commonly cited reasons given for selecting the pilot project area were:

1. Distance of project from university
2. An interested group sought help
3. Progressive leadership of county agent or agents
4. Major growing area for particular crop
5. Good producer organization to work with
6. Area with most problems.

The most common reason given for area selection was availability of qualified Extension personnel, followed by either cooperative chemical industry personnel or well organized farm leadership.

The decisions as to which producers and areas would be included in pilot project areas were made by project leaders, Extension specialists, agents, industry (processors), grower committees, and in one case, the Extension director.

In 7 of the 26 projects studied, written agreements or contracts between the university and the grower were used. Other projects required grower contracts between private consultants and producers, or between scouts and producer organizations. No legal problems or liability suits have arisen as a result of pest management recommendations.

Methods of Notifying Producers about Pilot Projects

Methods most frequently used in notifying producers about participating in pest management projects included: circular letters, meetings, mass media, and individual contacts. On a 0-to-10 scale (10 most effective), project leaders rated individual contacts and mass media with mean ratings of 3 and 4 respectively. Both circular letters and meetings, with mean ratings of 6 and 7 respectively, were rated slightly higher than other methods.

Continuing Communication with Producer after Project Initiation

Mass media, meetings, schools, workshops, field tours, summary of annual report, scout reports, newsletters and personal contacts were all used as communication methods with producers once projects were under way.

Project leaders (using a 0-to-10 rating scale) rated personal contact as the most effective communication method, with a mean rating of 8.9. Scout reports, with a mean rating of 8.5, were almost as effective. In a descending order of effectiveness were newsletters (7.2), radio (5.2), and news releases (4.8).

Recommendations

Pest control recommendations are usually delivered to growers by telephone, personal visit, or mail. They were always made by supervisors, program entomologists, agricultural agents, pest management contractors, area agronomists, and/or research personnel. Most projects included a method or methods for handling pest emergencies so that growers had ample time to take appropriate action. Recommendations "made" or "delivered" has different meaning to project leaders, county agents, supervisors, area agronomists, processors, project coordinators, pest management contractors, county entomologists, co-op chairmen and/or county pest management agents.

Most project leaders indicated that most production costs were considered when making individual recommendations, but only one indicated that the cost of specific chemicals was considered when recommendations were made.

Number of Producers Returning Each Year

Of the projects studied, returning producers averaged 97.5 percent, with many projects having all producers returning and some added new ones. In projects where some producers dropped out, project leaders listed one or more of the following reasons:

1. Internal problems within the local organization
2. Influence of persons opposed to pest management
3. Crops in production area changed because of weather or markets
4. Some producers retired, moved, etc.
5. Some producers resist change
6. Calendar spray schedule was preferred by some
7. Part-time farmers were too busy to do paperwork, etc.
8. Can do some things themselves
9. Personality conflict with scout
10. No weekly reports or contacts with growers, so if producer has no problem, there was little communication with project personnel, and producer felt that this program was of little value to him
11. Some programs that worked through processors already had a high degree of management, so the program did not greatly improve the situation of some farmers
12. Some changed to private programs as they became available.

Scouts

Scouts were selected and trained in a variety of ways. They usually were students from technical schools, high schools and colleges. High school teachers and young housewives were used in some projects. Several project leaders preferred scouts who live and work in the same community. This allows them to work before and after school and on weekends, especially important in the spring or after school starts in the fall. Depending on the project and state involved, recruiting and training scouts was done by project leaders, contractor supervisors, corporation managers, farmers and farmer leaders, county agents, county and area entomologists and farm advisors, pest management supervisors, pest management committees, grower committees or pest management specialists.

Scout training varied and ranged from no time in one project to 2 weeks in the classroom. All scouts received initial field training, but this varied from state to state. Most projects had some form of continuing training throughout the summer; this usually constituted the project leaders or scout supervisors spending half a day per week with scouts. All projects required that scouts know how to identify all major pests and know up-to-date methods for determining pest (and beneficial insects when included) populations, and how to report these findings accurately.

Project leaders, scout supervisors, agents, county entomologists, team leaders, and producers watched reports for apparent errors. Some supervisors spotchecked sample fields on the same day they were visited by the scout, and one spotchecked light traps before the scout's visit and compared trap catch with the scout's report. In at least one project the computer checked for missing data or "out of range" data. This indicated that quality control procedures were used in most projects.

Improved Educational Programs in Terms of Producer Acceptance of Recommended Practices

All but one project studied resulted in better pest management educational programs. One example of success was in a project area where a low rate of insecticide was recommended to suppress pest population and project beneficial species. The first year of the project no producers followed the recommendation, but in the second year 73 percent of project producers followed the low rate recommendation.

The number of producer meetings (ranged from 1 to 10 per year), field tours for producers and others (ranged from 0-41 per year), circular letters to producers and others (ranged from 2 to 10 per season), and radio, TV, "dial-a-bug" phones, etc., all improved the pest management programs. All but one project leader believed that pest management programs were better educational tools than the old ways of doing business and resulted in better and quicker acceptance and implementation of pest management practices.

CONTRIBUTIONS

Growers

Growers contributed funds on an acre basis in 17 of the 26 projects studied. Early in the developmental stage of projects, growers contributed in only 12 of the 26 projects. Reasons given by project leaders as to why growers did not contribute are:

1. Haven't asked them
2. Could use preventive program without project
3. Needed grower involvement immediately
4. Told growers it was federally funded project at beginning of project
5. Started project to determine if it would work
6. A charge may have resulted in less cooperation
7. Growers would not pay for present project.

Depending on the project involved, growers and agents, growers and pest management personnel, grower associations, processors, and steering committees all decided what the growers should pay. Strong grower involvement in establishing price was evident in most projects where producers were charged.

In 11 projects, growers were not asked, and in 13 projects growers were asked, if they would pay an acre charge for the program. In nine projects the majority of the growers said thay were willing to pay when asked, but only two project growers said they would not pay. In several projects, growers agreed among themselves to pay without being asked. Charges per acre have been changed (most upward) in 15 of the 26 projects since projects were started, indicating a willingness of growers to pay for the highly specialized advisory services.

Research

In response to the question "How involved have researchers been in the project?", project leaders answered as follows: 9 very; 3 extreme; 8 some; 1 little; 2 very little; and 3 with a question mark.

Research personnel associated with most projects served only as advisors. However, it was particularly apparent in many cotton projects that research and Extension personnel with well-coordinated programs provided more accurate thresholds, more efficient methods for monitoring, and better information delivery systems (especially where computers were used). Data accumulated from pest management projects have resulted in 39 economic threshold changes. Since many projects studied were heavily involved with entomological problems, little was said regarding the need for methods to be used in decisionmaking in areas of weed science and plant pathology. This situation is not changing in many projects.

"Is current research adequate?" Adequate was defined by most as meaning adequate for maintaining a satisfactory pest management program. Seven project leaders said "no" and 18 project leaders said "yes." Many project leaders (particularly outside cotton projects) indicated a need for better pest monitoring methods, more thresholds, more refinement of present thresholds, and better biological data.

Research personnel contributions vary in pest management projects, ranging from almost none to almost total guidance. However, there was no apparent correlation between research involvement and success or failure of projects.

Industry

In response to the question "In what ways does industry contribute?" Three project leaders answered "none" and 23 answered "some." Sponsoring a program to obtain stalk destruction by tobacco growers, actually furnishing space for headquarters, supplying materials for demonstration purposes, serving as a member on the steering and other committees, paying some scouting costs, and contracting to provide scouting services, were listed as ways industry personnel contributed. Industry personnel also contributed by serving in an advisory capacity in 18 of the projects studied. In seven of the projects, leaders identified positive changes that resulted from chemical industry suggestions.

State Regulatory Agencies

Contributions by State Departments of Agriculture and other agencies ranged from significant daily involvement to no involvement. In some projects, regulatory personnel provided numbers of services such as monitoring pests, keeping pest management personnel informed of pest movement, enforcing regulations where needed, assisting in hiring and supervising scouts, assisting in maintaining and storing data, assisting in collecting samples for environmental monitoring, routinely taking and testing blood samples from scouts, assisting with bee and fish kill problems, assisting with initial grower contracts, checking tank mixes of applicators to determine actual content, assisting with pest identification, and providing some residue work. It appears that where programs became area wide and where regulations and enforcement are necessary for success, then involvement by regulatory personnel is a must. Otherwise regulatory personnel involvement will depend on the kind and scope of project, personnel available, and interest of the regulatory agency.

COST AND FUNDING

Although cost of operating the projects varied greatly, project leaders generally agreed on type of programs and costs.

Public cost (pilot project money, university cost, and other agency costs, including personnel from other agencies) in pilot projects the beginning year ranged from 15 cents to $73.75 per acre. Public cost per acre during 1974 ranged from 25 cents to $57.87. Project leaders estimated that when projects were in full operation, public cost could range from 11 cents to $25 per acre. The apparent great difference in cost was due to development cost of sophisticated programs for use on high value crops and necessity of frequent and sometimes expensive labor-intensive monitoring costs of high value crops. The wide range of cost in some instances was attributable to monitoring for all pests while some programs were monitored for insects only. Public costs would involve training of personnel needed for pest management projects, educational literature, and some personnel to continue to revise and refine pest thresholds, monitoring methods, etc. Some projects will require funding for computer time as well.

Grower costs (payments) during the beginning year ranged from zero to $8 per acre. During the second year (1974) grower cost per acre ranged from zero to $9.86. Project leaders estimated that grower cost, when projects were in full operation, would range from 75 cents to $19.00 per acre. Again, the variation in cost is due to the number of pests involved, value of crop, necessity for control (economic threshold), and equipment and personnel needed for monitoring.

Private pest management programs will follow pilot projects in many areas. These programs may not be able to include small acreages, fields far apart, etc., which will require some kind of public program or farmer organization program if community-wide pest management is to become a reality. Training of personnel, demonstration of latest research findings, and providing Extension education and literature will in most instances require some public support in areas where pest management is handled by private consultants. In most instances project leaders indicated that the institutional cost of public sponsored programs would range from 10 cents to $5 per acre. Large acreage field crops usually were estimated at the lower cost range, and specialty crops grown on a limited acreage will have a high cost. Grower costs for private consultant programs were estimated at between $2 and $21 per acre. Most project leaders indicated that growers will be very willing to pay these costs since projects are in full operation.

The general trend in most projects was for less public cost and higher grower costs per acre as projects develop. The general trend toward higher cost to the grower as projects develop, and a general tendency toward more growers and more acres in many projects, indicates that producers have assumed increasingly more of the cost in many projects.

People Associated with Projects

Young people were hired as assistant project leaders or supervisors in 22 of the 26 projects studied. In many instances these people had recently completed a Master's or Ph.D.; some had little or no field experience. In most projects, Extension personnel with experience in pest management served as project leaders and provided the necessary guidance for younger, less experienced personnel. Researchers with similar experience provided valuable guidance in most projects.

Participation of survey entomologists varied from none to heavy involvement; one survey entomologist served as a project leader. In 14 projects, survey entomologists were not involved at all. In four projects they had little involvement or were involved only in planning. In four projects they helped or were responsible for personnel training; and in one project the survey entomologist did some scouting to back up regular scouts.

Contributions of area agents also varied. In many project areas there were no area agents. Where they were available, they often served as advisors, as assistant project leaders, as teachers or trainers, or as coordinators. Project leader opinion as to the future need for area pest management specialists varied from "none" to "great." Opinions of leaders regarding the need for an area team consisting of one man from each needed discipline, or for one area specialist trained in all disciplines, were almost equally divided.

Mistakes

In most pilot projects some errors were made regarding advice given. Many of these resulted from unexpected weather changes, or changes in pest complex or pest populations. Errors were not serious and usually resulted from inadequate knowledge of thresholds. In 88 percent of the projects where errors were made, the visable result of the mistake, measured in terms of grower acceptance, was not noticeable. In most instances, the producer understood the nature of developmental programs and learned along with project personnel. In one or two cases, a poor decision may have caused a temporary reduction in the project acreage or in a quickly adjusted program as corrective solutions were found. All projects were monitored constantly to improve precision and recommendations during this 3-year period.

Effects of Pesticide Shortage on Programs

Pesticide recommendations and types of chemicals used had to be changed in many programs in 1974 because of pesticide shortages. In addition to shortages, many pesticides were much more expensive in 1974 than in 1973. The increase in price caused producers to consider alternatives, including pest management programs. The higher cost chemicals made pest management more attractive to many growers.

Pest Management Programs and Energy Requirements

Energy was saved as a result of 20 of the 26 pest management programs. Energy requirements involved in manufacture, transportation, and application of chemicals obviously were much less where fewer applications of pesticides were required. As the costs of fuel for application and chemical costs increase, the economic advantage of pest management programs that lower this cost will become more important.

Impact of Projects on New Projects and on Private Consultants

Ten of the studied projects resulted in from 1 to 20 additional public and/or private projects. Eleven projects increased the number of private consultants in or near project areas.

Extension Personnel Liability

Many Extension personnel have voiced some concern regarding liability in recent years. Pest management programs deal more directly with people, and in many projects more directly with larger numbers of people than before. Project leaders were asked, "Do you think pest management programs increase the liability problem for Extension personnel in the eyes of the grower, eyes of your director, and in the eyes of the specialist?" Twenty-four leaders indicated no increase in the problem from the grower standpoint, 10 saw no indication of increased concern by their director, and 22 had no increase of concern over liability when dealing with pest management programs. The majority of project leaders expressed little apprehension about liability from conducting Extension programs.

In several instances project leaders were hesitant to discuss liability and how the university handled liability problems. Several answered the question, "How does the university handle liability problems?" with a question mark. One leader answered that university Extension personnel had a liability policy. Others listed protection by federal and state laws, and two project leaders indicated that the university had liability insurance. Agreement forms between university and producers were thought adequate to provide liability protection by two project leaders. Pest management groups (not directly a part of the university program) have liability coverage in two of the projects studied. There have been no lawsuits during the course of this pilot program.

Percentage of Crops that Can Be Handled by Public and Private Programs in Future

In the future, private and public programs are predicted as being adequate to cover from 10 to 100 percent of the acreage of the crops involved. Project leaders indicate that 84 percent of all acreage could be included in public and private programs. What happens to the remaining 14 percent? Project leaders suggest that some producers will do the necessary scouting themselves, and some will change crops. Others will watch neighbors in pest management programs, and some marginal producers will continue as they are now, or quit farming.

FUTURE PEST MANAGEMENT PROGRAMS

Personnel

Is there adequate personnel? Sixteen project leaders think there are enough scouts available to conduct pest management programs on all acreage of the particular crop or crops in their states. Only four project leaders indicated there would not be enough seasonal help available. In most instances project leaders thought that lack of scouts should not be considered a critical factor in developing programs. Adequate professional personnel can and will be trained.

Type of Programs for Future

Most leaders thought a trend toward a total management "package" would occur. More crops and management practices would be added. Monitoring cost would be reduced by more concentrated acreages (less time and travel), better monitoring (pheromones, modeling), not monitoring for minor pests, automatic forecasting for disease, remote sensing, use of mobile labs, better sampling techniques, mechanization, and use of resistant varieties. Those changes would make projects more practical and economically attractive to growers. Grower organizations, food processors, gins, consulting firms, and others in the private sector are expected to become active leaders in pest management. There was no agreement as to what would happen if all federal money is withdrawn at the end of the pilot period. Included in their predictions were:

1. Revert back to "old way"
2. May form cooperatives
3. Be taken over by private industry
4. Deteriorate over a period of few years
5. Continue, but with limited program quality and advancement
6. Continue with state money
7. Continue with grower, state and county money
8. Lower acreage in project
9. Go to private consultants.

All are of the opinion that some federal money is needed for Extension leadership; for continuity of programs; updating thresholds; and for training personnel of industry, co-ops, processors, and gins. In this case many project leaders predicted expansion of projects to other crops, improved quality of programs, and expansion to other areas of the state.

Observations on Types of Programs

It became apparent during the course of this study that pest management projects can be classified into three categories:

1. Pesticide use management systems
2. Insect management programs
3. Pest management programs.

Pesticide use management systems are those where scouts are used to determine when pesticides should be applied and to monitor the results of the program based almost entirely on chemical control.

Insect management programs are those programs where insect pests are almost exclusively the only pests included in the program.

Pest management programs include major pests of a crop regardless of discipline and incorporate all applicable management methods for major pests.

It appears that in most instances project leaders chose one of the three types of programs that would be acceptable to producers in the project area and started with this type of project. It also appears that there was, during the 3-year period, a tendency for projects to move from pesticide use programs toward insect management projects, and in some instances toward total pest management projects.

If recommendations of the majority of project leaders on how to develop an ideal pilot project were simplified and summarized, they could be listed as follows:

1. Consider major pest problems and include scientists from all discplines involved
2. Develop monitoring systems for pests and establish thresholds from current information
3. Put proposal together and allow review by those listed in item 4
4. Establish advisory committee with strong Extension agent, and producer
5. Include in the program those management elements wanted by the producer as well as those needed to "sell" a project
6. Select a project leader experienced in crop production practices, including economics of crops production
7. Select an "open-minded," young and enthusiastic assistant project leader
8. Gain support of area or county personnel, especially in contacting growers
9. Hire and train adequate scouts and supervisory personnel; training must be adequate and continuous
10. Monitor all phases of project constantly for errors and opportunities for improving efficiency and reliability

11. Evaluate the project constantly and make necessary changes quickly, including any new material available from research.

12. Provide effective communication on program success and progress to participating growers and the community

13. Advise administrators of progress

14. As economics and production problems change, make necessary changes in project, including addition of other crops and disciplines when needed.

There are some pitfalls that many project leaders felt could be avoided to assure program success in a short period of time. One was to take care of selecting the initial size of a pilot project. The size should be smaller than that believed to be maximum for effective management. In established program areas (example, cotton) in some states, this may not apply. Evaluation and rapid adjustment of large projects are more difficult.

Most project leaders indicated that administrative support and commitments were necessary for successful projects. Some caution may be advisable, however, where "strong support" by administration (particularly at the department level) has occurred, because departmental interest may prevent and render less effective needed interdisciplinary participation. Frequently, the participation of several crop protection disciplines is required to meet grower needs.

Failure to include area and county agents in an advisory capacity, with even more involvement where needed, may have slowed success in some cases. In some instances food processors and others in the private sector have been involved as advisors instead of county and area Extension personnel. Failure to include representatives of other state and federal government and industry representatives may result in poor communication and misunderstanding.

Criticism of scout training is an example of a misunderstanding. In many cases, those who criticized did not understand that scouts usually identify, count, and record pest occurrences. They do not make recommendations to farmers. Some do not understand that scout training is virtually continuous throughout the season. In some projects, leaders were sensitive to comments by producers and industry personnel, investigated the causes quickly, and took appropriate action.

Failure to make quick adjustments in projects also may slow progress. If producers will not support a part of a project at the end of a pilot phase, then program adjustments appear justified. If producers are told at the beginning of the project there will be no charges during the pilot phase, then the possibility of developing a project with grower support is reduced, and whether grower support will follow can only be known after pilot funds are no longer available.

Failure to branch out from initial project areas (particularly where only one county was involved) as quickly as possible may slow grower acceptance rate in other areas of the state. Should this occur after pilot funds are no longer available, it presents a difficult problem. Many project leaders indicated the acceptance of the program will be much greater and faster where a large number of producers can observe the results of the program.

APPENDIX I

USDA-CES PEST MANAGEMENT PILOT PROJECTS
1972-1974

State	Crop(s)	Pest(s)
Alabama*	Cotton	Insects
Arizona*	Cotton, safflower, sugarbeets, alfalfa, small grains	Insects
Arkansas*	Cotton	Insects
California*	Cotton Pears	Insects Insects, Diseases
Delaware*	Peppers, beans, potatoes	Insects
Florida	Citrus	Insects, Diseases
Georgia	Cotton	Insects
Idaho	Potatoes	Insects
Illinois*	Corn	Insects, Weeds
Indiana*	Alfalfa Corn	Insects Insects, Weeds
Iowa*	Corn	Insects, Weeds
Kansas	Grain sorghum	Insects, Weeds
Louisiana	Cotton	Insects
Maryland*	Sweetcorn, beans	Insects
Michigan*	Deciduous fruits	Insects, Weeds, Diseases, Rodents
Mississippi	Cotton	Insects
Missouri*	Corn Cotton	Insects Insects
Nebraska*	Corn Grain Sorghum	Insects, Weeds Insects, Weeds

* Projects included in this study

New Jersey*	Sweetcorn, lettuce	Insects, Diseases
New Mexico	Cotton	Insects
New York	Apples	Insects, Diseases
North Carolina*	Cotton	Insects
	Tobacco	Insects, Weeds, Nematodes, Diseases
Ohio*	Corn	Insects, Weeds
Oklahoma*	Cotton	Insects
	Grain Sorghum	Insects
	Peanuts	Diseases, Nematodes, Insects, Weeds
Pennsylvania	Apples	Insects, Diseases
South Carolina*	Cotton	Insects
Tennessee	Cotton	Insects
Texas*	Cotton	Insects
	Grain Sorghum	Insects, Weeds
	Peanuts	Insects, Diseases, Nematodes, Weeds
Washington*	Alfalfa (Seed)	Insects
	Apples, Pears, Peaches	Insects

APPENDIX II
QUESTIONAIRE USED

Program Organization

Personnel Involved

Committees

Steering (rate 0-10 for effectiveness)

Representative from Background

Action (rate 0-10 for effectiveness)

Representative from Background

Other committees (rate 0-10 for effectiveness)

Representative from Background

How often do these committees meet?____________________________.

What do they do at meetings?_______________________________

____.

Adminstrators

How many administrators are involved with the project?_______.

Background?____

____.

Project leader or leaders

Background (training and experience) in responsibility delegated:

____

____.

Assistant Project leader

Background (training and experience):_______________________

____.

County Agents

Background (training and experience):_______________________

____.

Scout Supervisors

Background (training and experience):_______________________

____.

Scouts

Background (training and experience):_______________________

____.

Please rate pest management effort of each

Personnel	Strong effort	Expected effort	Some effort	Little effort
Administrators				
Project leader				
Asst. Proj. leader				
County Ag. agent				
Scout supervisors				
Scouts				
Others				

Producers

Number each year of project?______________________________.
Area or Area of state?____________________________________.
Producers' background______________________________________
____

Others

Crop

How serious are pest problems?______________________________________.
Which disciplines involved with serious problems?__________________
____

Which disciplines involved in project?_______________________________.
Should more disciplines be involved?_______________________________
If so why are they excluded?_______________________________________
____.

Crop value (gross) per acre?______________________________________.
Production cost per acre?____.
How important is pest control to production of this crop?__________
____.

Have yields increased as a result of pest management?______________
____.

Has quality improved as a result of pest management?_______________
____.

Has pesticide use increased?______________________________________.
Decreased?______Remained the same?____________
(as a result of pest management)
Measure change in poundage or number of applications_____________
____.

Project:

Any special problems associated with project (small fields. fields apart, etc). Could a multicrop project increase efficiency and lower pest management cost.

Scope of project

	Crop				
	acres	fields	farmers	scouts	scout supvrs
1st year					
2nd year					
3rd year					

Evaluation

How often is the project evaluated?____________________________.

What methods used to evaluate?______________________________

____.

Do they include?____

Evaluation of influence of project grower on neighbors?_________

____.

Use pattern of insecticides, amounts and kinds?________________

____.

Yield quality and quantity?__________________________________

____.

Production cost?____

____.

Net profit?____

____.

What adjustments in the program have been made as a result of evaluation?____

____

____

____

____

____

____

____

____.

Project

Does the program include things not directly related to pest management? (fertility recommendations etc.)____
____
____.

If so, have these helped "sell" the program?______________________________.

Do you have contracts or written agreements with individual grower?______
____.

What method or methods were used to select growers and areas of state for the program?____
____
____.

Who made the final decision?____
____

What methods were used to inform growers of the availiability of the program?

Method (0-10 for effectiveness)

1.____
2.____
3.____
4.____

What methods of communication are used with the grower during the season?

Method		Frequency	(0-10 for effectiveness)

Who makes the recommendations?____.

Are production costs considered when making recommendations?__________
____.

Are they made pre-plant?____.
pre-emergence?____.
post-emergence?____.

How are they delivered to the grower?____________________________________.
Who delivers them?____.

Number of growers returning each year?____________________________.

Why do growers drop out?____

____

____.

What percentage of total acres do you estimate can be handled by a public or private program?____________________________________.
What happens to the other percentage in future years?______________

____

____.

Who interviews and hires the scouts?______________________________

____.

Where are scouts found?____

____.

How are scouts trained?____

____.

How is quality control on scout activities measured?______________

____.

Educational activities resulting from Pest Management

Meetings?____.
Tours?____.
Letters?____.
Mass media?____.

Have the above activities improved the educational program in terms of grower acceptance of recommendations?________________

____

____.

Grower Contribution

Do growers contribute?____
If so, who decides what they will contribute?__________________

____.

Did the grower contribute during the early phases of the project?

____.

If growers do not contribute, what are the reasons?_______________

____.

Have you or did you ask growers what they would pay?____________________
____.

What did they say?____
____.

Have charges to the producer been changed since the program started?____
____.

Research Contribution

Did the project have an adequate research backup? ________________
____.

How involved have researchers been in the project?________________
____.

In what capacity?____.

How dependant are you on economic thresholds?____________________
____.

How have you modified thresholds as a result of this program?______
____.

How many do you have?____________________Need?____________________.

How many significant changes have you made due to new research findings since the project started?______________________________.

How many would you estimate could be made in the next 3 years?
____.

In your opinion, is current research effort adequate to produce positive changes in programs that will contribute to production efficiency, quality of product, or the environment?________________
____
____.

Industry Contribution

In what ways does industry contribute?___________________________.

Have industry people been informed of progress in the programs?____
__________________________________How?_______________________

State Department Contributions and/or Regulator Contribution

What logical ways can they help?__________________________________
____

How have they helped?____
____
____.

Cost and Funding

Cooperative Extension Service Program. Now and Future

Cost/acre

	Start	1974/Now	Estimate When in full operation
Public cost			
Grower cost			
private Other groups			
TOTAL			

Private Program

Public support			
Growers			
TOTAL			

		% Acres	% Growers	
	Now	Future	Now	Future
C.E.S. Program				
Private Program				

Type of quality of present and future pest management advisory service -- public vs. private.

Examples:

General Questions

Have you delegated responsibilities to young people or leaders?____.

How many other pest management projects have been started as a result of this project?__________________________.

Are there other crops and pests ready for projects or other pest management projects deeded in the state?_____________.

What is relationship of survey entomologist to this program?

____.

What is relationship of area agents to program?_____________

____.

What is future of area crop control specialists?_____________

____.

Should it be an area entomologist, area weed specialist, area plant pathologist, area horticulturist etc.; or would it be better to have an area plant protection specialist?__________.

How has shortage of pesticides affected the program?_________

____.

How has the program resulted in energy conservation? (number of applications saved etc.) Ground________Aerial__________.

Frequency of monitoring mistakes (on advice)?_______________

____.

Have there been mistakes in advice?________________________.
If so, what was the effect on the program?__________________

____

____

____.

What impact has this program had on the number of private consultants in the state?___________________________________

____.

Liability (seriousness of?)
   Any problems (eyes of grower)___________________________.
                (eyes of director)_________________________.
                (eyes of specialist)_______________________.
   Any lawsuits?_______________________________________.
   Liability judgements?_________________________________.

Does pest management group have liability insurance?__________.

How does university handle these things?___________________

____.

How are private consultants handling liability?_______________
____.

Are their programs different from yours?______________________
____.

In time, will there be enough personnel to run programs. (Example: if we go to 80% cotton acreage, will there be enough scouts and supervisors)________________________________
____
____.

What type of program (for private sector) needs to be developed to give year-round employment for professional people?________
____
____.

Who collects money__________________pays scouts________________
and scout supervisors____

What ideas do you have on reduction in cost of monitoring? (Example: modeling and prediction capabilities)______________
____
____.

Future

What happens when pilot program funds are no longer available?

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